

CLAIMS

We Claim:

1 1. A method for determining a turn-on energy of a printhead comprising:
2 firing the printhead at a first firing frequency over an initial range of print
3 energies to detect an approximate range of print energies in which the turn-on
4 energy is located; and,

5 firing the printhead at a second firing frequency over the approximate
6 range of print energies in which the turn-on energy is located in order to
7 determine a value for the turn-on energy of the printhead, wherein the second
8 firing frequency is higher than the first firing frequency.

1 2. A method as in claim 1 wherein the second firing frequency is more than
2 twice the first firing frequency.

1 3. A method as in claim 1 wherein:
2 firing the printhead at the first firing frequency over the initial range of
3 print energies comprises passing a first plurality of substantially constant voltage
4 electric signals through heater resistors within the printhead and varying a pulse
5 width of the first plurality of substantially constant voltage electric signals within
6 a first range of pulse widths; and

7 firing the printhead at the second firing frequency over the approximate
8 range of print energies in which the turn-on energy is located comprises passing a
9 second plurality of substantially constant voltage electric signals through the
10 heater resistors and varying a pulse width of the second plurality of substantially
11 constant voltage electric signals within a second range of pulse widths narrower
12 than the first range of pulse widths.

1 4. A method as in claim 3 wherein:
2 varying the pulse width of the first plurality of substantially constant
3 voltage electric signals comprises reducing a pulse width of each successive signal
4 in the first plurality of substantially constant voltage electric signals; and,

5 varying the pulse width of the second plurality of substantially constant
6 voltage electric signals comprises reducing a pulse width of each successive signal
7 in the second plurality of substantially constant voltage electric signals.

1 5. A method as in claim 3 wherein:

2 varying the pulse width of the first plurality of substantially constant
3 voltage electric signals comprises reducing a pulse width of each successive signal
4 in the first plurality of substantially constant voltage electric signals by a first
5 amount;

6 varying the pulse width of the second plurality of substantially constant
7 voltage electric signals comprises reducing a pulse width of each successive signal
8 in the second plurality of substantially constant voltage electric signals by a
9 second amount; and,

10 the second amount is smaller than the first amount.

1 6. A method as in claim 1 wherein:

2 when firing the printhead at the first firing frequency, different print
3 energies are obtained by varying pulse width of an electric signal passed through
4 heater resistors within the printhead; and,

5 when firing the printhead at the second firing frequency, different print
6 energies are obtained by varying pulse width of an electric signal passed through
7 heater resistors within the printhead.

1 7. A method as in claim 1 additionally comprising:

2 firing ink at additional print frequencies in order to more accurately
3 determine the value for the turn-on energy of the printhead.

1 8. A method as in claim 1 wherein the approximate range of print energies
2 in which the turn-on energy is located is detected by monitoring temperature of
3 the printhead in order to approximate a range of pulse widths where a minimum
4 temperature of the printhead occurs.

1 9. A method as in claim 1 wherein the value for the turn-on energy is
2 determined by monitoring temperature of the printhead in order to determine a
3 pulse width where a minimum temperature of the printhead occurs.

1 10. A method for determining a turn-on energy of a printhead comprising:
2 firing the printhead at a first firing frequency over an initial range of print
3 energies to detect an approximate range of print energies in which the turn-on
4 energy is located, including:

5 passing a first plurality of substantially constant voltage electric
6 signals through heater resistors within the printhead and reducing a pulse width
7 of each successive signal in the first plurality of substantially constant voltage
8 electric signals; and,

9 firing the printhead at a second firing frequency over the approximate
10 range of print energies in which the turn-on energy is located in order to
11 determine a value for the turn-on energy of the printhead, including:

12 passing a second plurality of substantially constant voltage electric
13 signals through the heater resistors and reducing a pulse width of each successive
14 signal in the second plurality of substantially constant voltage electric signals by a
15 second amount;

16 wherein the second firing frequency is higher than the first firing frequency.

1 11. A method as in claim 10 wherein the second firing frequency is more
2 than twice the first firing frequency.

1 12. A method as in claim 10 additionally comprising:
2 firing ink at additional print frequencies in order to more accurately
3 determine the value for the turn-on energy of the printhead.

1 13. A method as in claim 10 wherein the second amount is smaller than the
2 first amount.

1 14. A method as in claim 10, wherein the approximate range of print
2 energies in which the turn-on energy is located is detected by monitoring
3 temperature of the printhead in order to approximate a range of pulse widths
4 where a minimum temperature of the printhead occurs.

1 15. A method as in claim 10, wherein the value for the turn-on energy is
2 determined by monitoring temperature of the printhead in order to determine a
3 pulse width where a minimum temperature of the printhead occurs.

1 16. A device comprising:
2 a printhead used to eject ink; and,
3 a controller that controls ejection of ink from the printhead, wherein the
4 controller determines a turn-on energy of the printhead by causing the printhead
5 to fire ink at a first firing frequency over an initial range of print energies to detect
6 an approximate range of print energies in which the turn-on energy is located, and
7 by causing the printhead to fire ink at a second firing frequency over the
8 approximate range of print energies in which the turn-on energy is located in
9 order to determine a value for the turn-on energy of the printhead, wherein the
10 second firing frequency is higher than the first firing frequency.

1 17. A device as in claim 16 wherein the printhead includes a temperature
2 sensor used to detect approximate temperature of the printhead.

1 18. A device as in claim 16 wherein the second firing frequency is more
2 than twice the first firing frequency.

1 19. A device as in claim 16 wherein when the printhead fires at the first
2 firing frequency, different print energies are obtained by varying pulse width of
3 an electric signal passed through heater resistors within the printhead.

1 20. A device as in claim 16 wherein when the printhead fires at the second
2 firing frequency, different print energies are obtained by varying pulse width of
3 an electric signal passed through heater resistors within the printhead.

1 21. A device as in claim 16:

2 wherein when the printhead fires at the first firing frequency, different
3 print energies are obtained by the printhead fires using a first plurality of pulse
4 widths of an electric signal passed through heater resistors within the printhead;
5 wherein when the printhead fires at the second firing frequency, different
6 print energies are obtained by the printhead fires using a second plurality of pulse
7 widths of the electric signal passed through heater resistors within the printhead;
8 and,

9 wherein the second plurality of pulse widths are spaced closer together
10 than the first plurality of pulse widths.

1 22. A device as in claim 16, wherein the device is a printer.

1 23. A device as in claim 16, wherein the device is used within a printer.

1 24. A device as in claim 16 wherein the controller causes the printhead to
2 fire ink at additional print frequencies in order to more accurately determine the
3 value for the turn-on energy of the printhead.

1 25. A device as in claim 16 wherein the approximate range of print energies
2 in which the turn-on energy is located is detected by monitoring temperature of
3 the printhead in order to approximate a range of pulse widths where a minimum
4 temperature of the printhead occurs.

1 26. A device as in claim 16 wherein the value for the turn-on energy is
2 determined by monitoring temperature of the printhead in order to determine a
3 pulse width where a minimum temperature of the printhead occurs.

1 27. A device comprising:
2 a printhead used to eject ink; and,
3 a controller that controls ejection of ink from the printhead, wherein the
4 controller determines a turn-on energy of the printhead by causing the printhead
5 to fire ink at a first firing frequency over an initial range of print energies to detect
6 an approximate range of print energies in which the turn-on energy is located,
7 including passing a first plurality of substantially constant voltage electric signals
8 through heater resistors within the printhead and reducing a pulse width of each
9 successive signal in the first plurality of substantially constant voltage electric
10 signals, and by causing the printhead to fire ink at a second firing frequency over
11 the approximate range of print energies in which the turn-on energy is located in
12 order to determine a value for the turn-on energy of the printhead, including
13 passing a second plurality of substantially constant voltage electric signals
14 through the heater resistors and reducing a pulse width of each successive signal
15 in the second plurality of substantially constant voltage electric signals by a
16 second amount;
17 wherein the second firing frequency is higher than the first firing frequency.

1 28. A device as in claim 27 wherein the printhead includes a temperature
2 sensor used to detect approximate temperature of the printhead.

1 29. A device as in claim 27 wherein the second firing frequency is more
2 than twice the first firing frequency.

1 30. A device as in claim 27, wherein the second amount is smaller than the
2 first amount.

1 31. A device as in claim 27, wherein the device is a printer.

1 32. A device as in claim 27, wherein the device is used within a printer.

1 33. A device as in claim 27 wherein the controller causes the printhead to
2 fire ink at additional print frequencies in order to more accurately determine the
3 value for the turn-on energy of the printhead.

1 34. A device as in claim 27, wherein the approximate range of print
2 energies in which the turn-on energy is located is detected by monitoring
3 temperature of the printhead in order to approximate a range of pulse widths
4 where a minimum temperature of the printhead occurs.

1 35. A device as in claim 27, wherein the value for the turn-on energy is
2 determined by monitoring temperature of the printhead in order to determine a
3 pulse width where a minimum temperature of the printhead occurs.

1 36. A device comprising:
2 means for ejecting ink; and,
3 means for controlling the ejection of ink, wherein the controller determines
4 a turn-on energy of the means for ejecting ink by causing the means for ejecting
5 ink to fire ink at a first firing frequency over an initial range of print energies to
6 detect an approximate range of print energies in which the turn-on energy is
7 located, and by causing the means for ejecting ink to fire ink at a second firing
8 frequency over the approximate range of print energies in which the turn-on
9 energy is located in order to determine a value for the turn-on energy of the means
10 for ejecting ink, wherein the second firing frequency is higher than the first firing
11 frequency.

1 37. Storage media that stores programming which when executed on a
2 printing device, performs a method for determining turn-on energy of a
3 printhead, the method comprising:
4 firing the printhead at a first firing frequency over an initial range of print
5 energies to detect an approximate range of print energies in which the turn-on
6 energy is located; and,

7 firing the printhead at a second firing frequency over the approximate
8 range of print energies in which the turn-on energy is located in order to
9 determine a value for the turn-on energy of the printhead, wherein the second
10 firing frequency is higher than the first firing frequency.

1 38. Storage media as in claim 37 wherein the second firing frequency is
2 more than twice the first firing frequency.

1 39. Storage media as in claim 37 wherein:

2 firing the printhead at the first firing frequency over the initial range of
3 print energies comprises passing a first plurality of substantially constant voltage
4 electric signals through heater resistors within the printhead and varying a pulse
5 width of the first plurality of substantially constant voltage electric signals within
6 a first range of pulse widths; and

7 firing the printhead at the second firing frequency over the approximate
8 range of print energies in which the turn-on energy is located comprises passing a
9 second plurality of substantially constant voltage electric signals through the
10 heater resistors and varying a pulse width of the second plurality of substantially
11 constant voltage electric signals within a second range of pulse widths narrower
12 than the first range of pulse widths.

1 40. Storage media as in claim 39 wherein:

2 varying the pulse width of the first plurality of substantially constant
3 voltage electric signals comprises reducing a pulse width of each successive signal
4 in the first plurality of substantially constant voltage electric signals; and,

5 varying the pulse width of the second plurality of substantially constant
6 voltage electric signals comprises reducing a pulse width of each successive signal
7 in the second plurality of substantially constant voltage electric signals.

1 41. Storage media as in claim 39, wherein:

2 varying the pulse width of the first plurality of substantially constant
3 voltage electric signals comprises reducing a pulse width of each successive signal

4 in the first plurality of substantially constant voltage electric signals by a first
5 amount;
6 varying the pulse width of the second plurality of substantially constant
7 voltage electric signals comprises reducing a pulse width of each successive signal
8 in the second plurality of substantially constant voltage electric signals by a
9 second amount; and,
10 the second amount is smaller than the first amount.

1 42. Storage media as in claim 37, wherein the approximate range of print
2 energies in which the turn-on energy is located is detected by monitoring
3 temperature of the printhead in order to approximate a range of pulse widths
4 where a minimum temperature of the printhead occurs.

1 43. Storage media as in claim 37, wherein the value for the turn-on energy
2 is determined by monitoring temperature of the printhead in order to determine a
3 pulse width where a minimum temperature of the printhead occurs.

1 44. Storage media that stores programming which when executed on a
2 printing device, performs a method for determining turn-on energy of a
3 printhead, the method comprising:

4 firing the printhead at a first firing frequency over an initial range of print
5 energies to detect an approximate range of print energies in which the turn-on
6 energy is located, including:

7 passing a first plurality of substantially constant voltage electric
8 signals through heater resistors within the printhead and reducing a pulse width
9 of each successive signal in the first plurality of substantially constant voltage
10 electric signals; and,

11 firing the printhead at a second firing frequency over the approximate
12 range of print energies in which the turn-on energy is located in order to
13 determine a value for the turn-on energy of the printhead, including:

14 passing a second plurality of substantially constant voltage electric
15 signals through the heater resistors and reducing a pulse width of each successive

16 signal in the second plurality of substantially constant voltage electric signals by a
17 second amount;
18 wherein the second firing frequency is higher than the first firing frequency.

1 45. Storage media as in claim 44 wherein the second firing frequency is
2 more than twice the first firing frequency.

1 46. Storage media as in claim 45 additionally comprising:
2 firing ink at additional print frequencies in order to more accurately
3 determine the value for the turn-on energy of the printhead.

1 47. Storage media as in claim 45 wherein the second amount is smaller than
2 the first amount.

1 48. Storage media as in claim 44, wherein the approximate range of print
2 energies in which the turn-on energy is located is detected by monitoring
3 temperature of the printhead in order to approximate a range of pulse widths
4 where a minimum temperature of the printhead occurs.

1 49. Storage media as in claim 44, wherein the value for the turn-on energy
2 is determined by monitoring temperature of the printhead in order to determine a
3 pulse width where a minimum temperature of the printhead occurs.